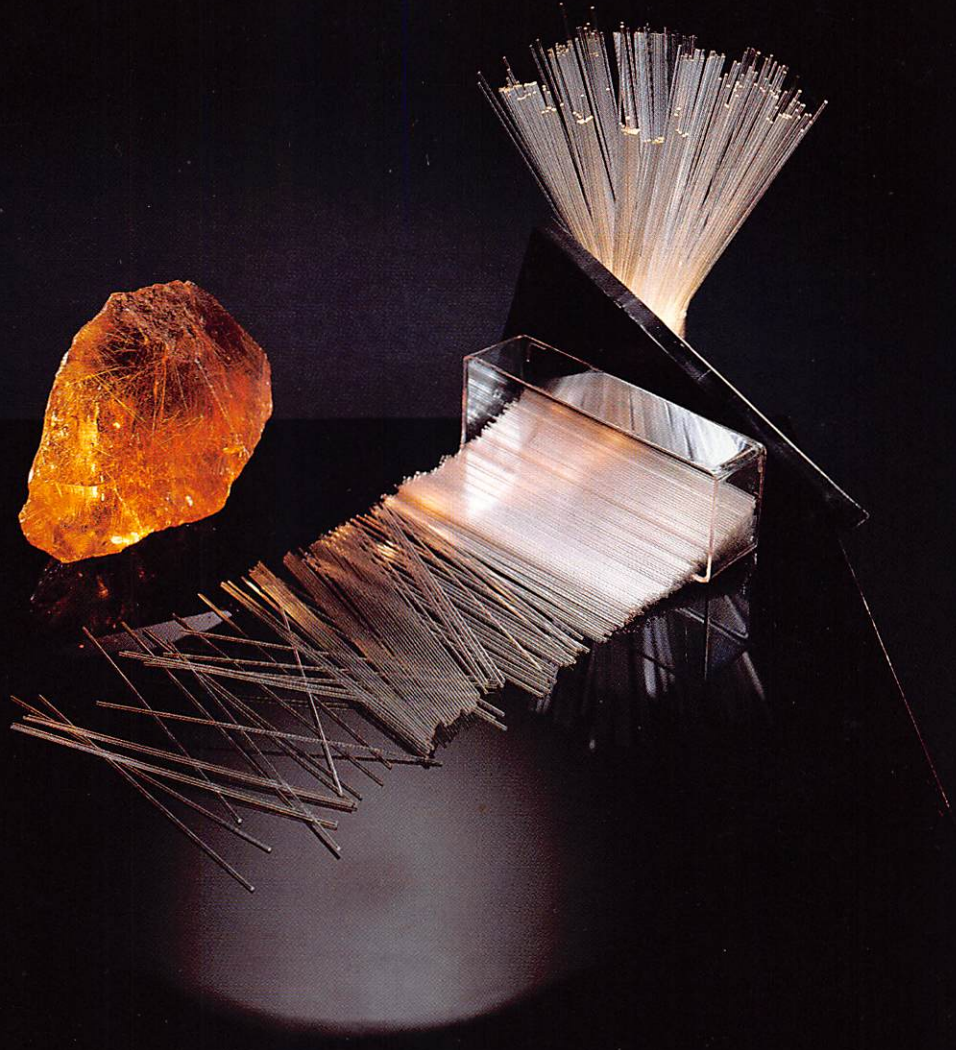
Sutter Instrument Company

Manufacturers of Precision Instrumentation



Micropipette Pullers
Optical Filter Changers
Micromanipulators
Micropipette Bevelers
Pressure Injectors
Capillary Tubing

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Phone 415-883-0128 Fax 415-883-0572

SUTTER INSTRUMENT COMPANY

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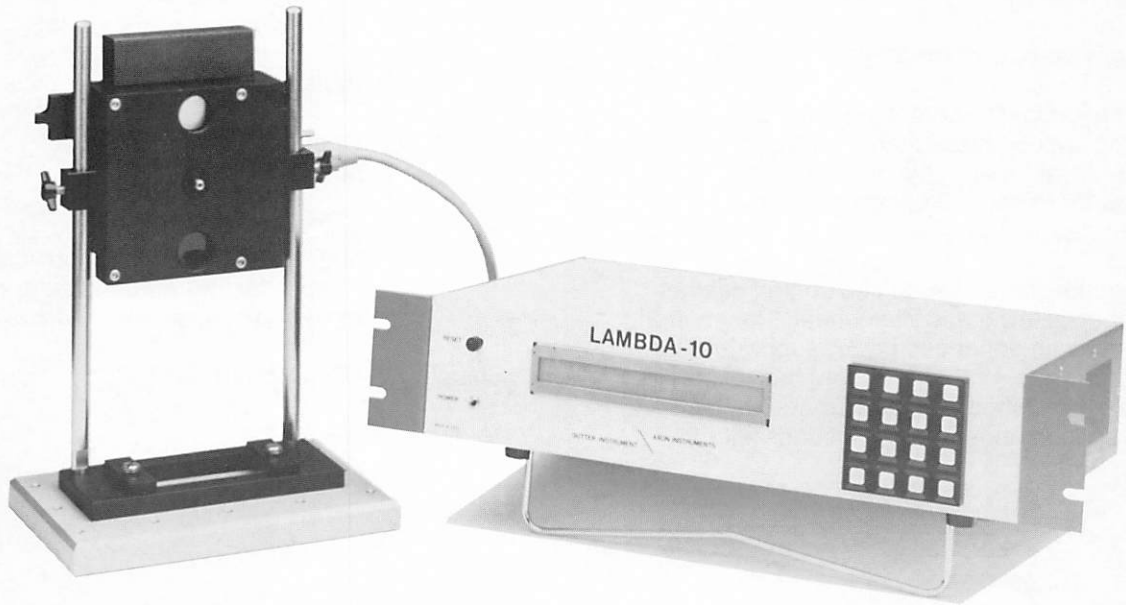
LAMBDA-10
OPTICAL FILTER WHEEL



The Lambda-10 is a microprocessor controlled, high speed filter wheel. Its impressive speed coupled with exceptionally smooth operation make the Lambda-10 ideal for research applications involving fluorescence microscopy, spectrophotometry, visual physiology, or any application requiring rapid and accurate aperture positioning.

The Lambda-10 consists of a filter wheel, a rack mountable controller, a support base and mounting rods, a controller/filter wheel interface cable, a parallel interface cable, and two drop in filter holders.

The wheel can hold up to ten optical filters (25mm in diameter and up to 9mm thick) which are easily loaded through an access port on the housing. Additional filters (e.g. heat and/or neutral density filters) may be inserted manually at two other locations in the optical path.

The optical ports on both sides of the unit are internally threaded as C-mounts ($1/32$" TPI).

When mounted in an upright position, the center of the optical port can be positioned from 11 cm to 53 cm above the mounting surface with the associated support hardware. The wheel can also be inverted to position the optical port 1.7 cm above the mounting surface. Slide-in filter holders are optionally available for inverted configurations.

Ten user selectable speeds are provided. Filter to adjacent filter time can be set from 50 to 1200 milliseconds, depending on the number and weight of the filters mounted in the wheel. High speed option discussed below will allow filter changing in less than 33 milliseconds.

A direct-drive stepper motor using advanced microstepping technology and intelligent acceleration and deceleration algorithms assures the fastest possible moves for a given inertial load, while minimizing vibration. The controller also has an error detection and correction circuit in the event that a position error occurs.

The Lambda-10 can be operated from a keypad on the front panel of the controller, or from a remote computer through a parallel interface.

For precise control of exposure time, an optional high-speed shutter assembly is available for the Lambda-10. Adapters for Nikon, Zeiss and Olympus microscopes are also available.

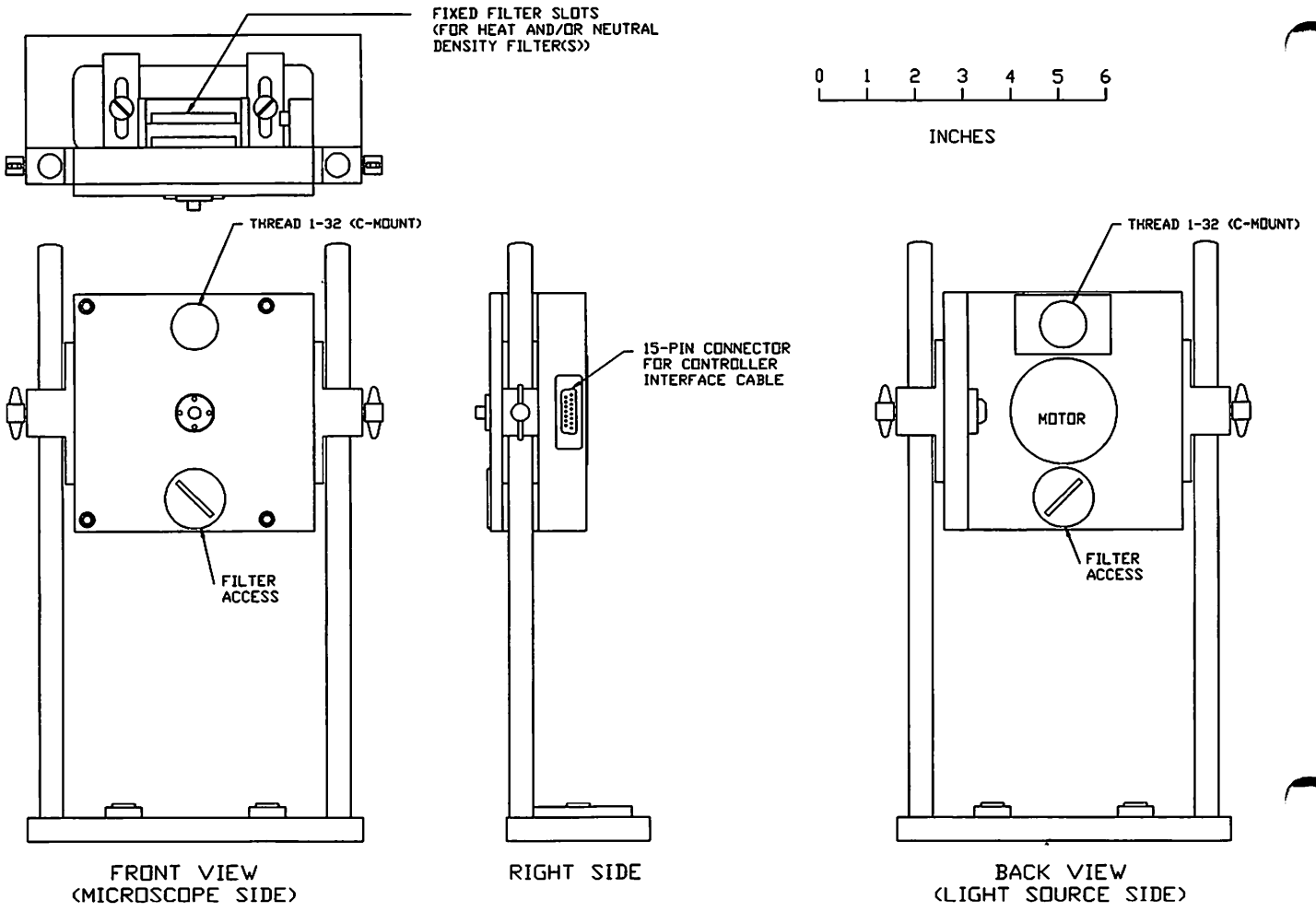
A Faster Lambda 10 for 2 Filter Switching

A new option for the Lambda 10 that improves switching speed to less than 32 milliseconds has been developed. This high speed option is intended for use with 2 optical filters and a blocking disk.

The option includes a modified control cabinet and a special low mass filter wheel. The control cabinet has an enhanced power supply and new control firmware. With this option, the 10 speeds available are shifted to a faster range, with 2 usable speeds under 32 milliseconds filter to filter. In order to minimize inertia, a new filter holding wheel has been designed that carries just 3 filter positions. The mechanical housing, external appearance, shutter option and pricing are the same as the standard unit.

Specifications and Ordering Information:

Size:	Controller – 16″x11″x3.5″ Filter Wheel – 5″x5″x2.25″
Weight:	Approx. 25 lbs.
Electrical:	Operates on 115/220 volts 50/60 Hz power line
Warranty:	One year limited warranty, parts and labor. Repairs of modifications without factory authorization, or misuse or abuse will void warranty.
Shipping:	FOB Novato, CA
Terms:	Net 30



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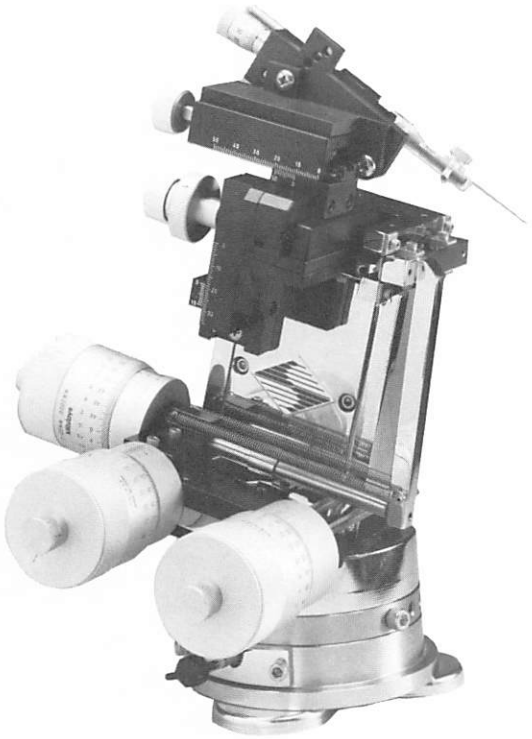
MODEL MP-85 — HUXLEY-WALL TYPE MICROMANIPULATOR



The Model MP-85 Micromanipulator manufactured by the Sutter Instrument Company is the J.R. Wall derivation of the classic Huxley design.

The manipulator proper is constructed of solid brass and is chrome plated. Micrometer holders are of aluminum and are black anodized. The rotating base is machined from solid stainless steel with a brass spindle; a thin teflon membrane provides the bearing surface.

Features

Dual springing of the moment arms to insure zero backlash and zero torsion.

The manipulator is mounted on a precision rotating base featuring a positive stop and lock.

The coarse movement is a German built, all cross-roller bearing design consisting of coase X, Y, and Z with an additional fine X motion.

Coarse X axis can be manually tilted 0-40°.

Coarse resolution is 0.1 mm on all axes.

Fine X resolution is 0.01 mm.

Ultrafine (Huxley) resolution is 0.2 microns.

The manipulator is a 'handed' design. Please specify left or right hand when ordering.

Accessories

Fifteen degree stackable wedges for tilting the manipulator.

A set of three magnetic feet for added stability.

One inch thick solid brass riser blocks.

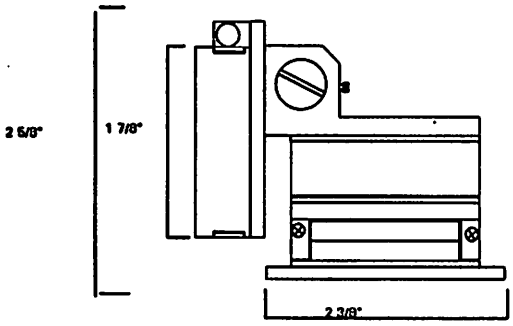
Specifications and Ordering Information

Size:	10" x 10" x 12"
Weight:	Approx. 15 lbs.
Warranty:	One year limited warranty, parts and labor. Repairs or modifications without factory authorization, or misuse or abuse will void warranty.
Shipping:	F.O.B. Novato, CA
Terms:	Net 30

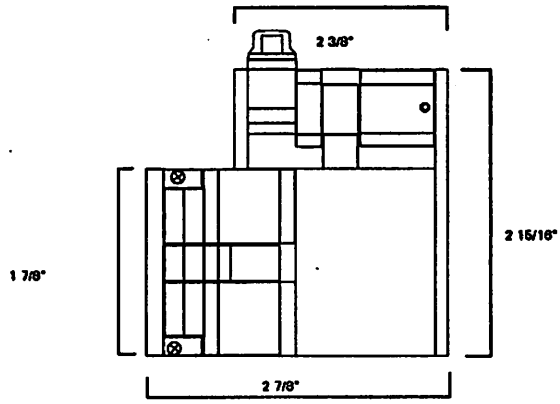
Please contact the factory for additional information on the suitability of this instrument for your application.

MP-300

Ultra-Stable, Submicron Micromanipulator
Submicron step size over entire 1/2 inch excursion
Drift-free, locking movement
User-programmable attributes
Hand-held remote control



Side View



Top View

The MP-300 is the latest in the Sutter Instrument line of micromanipulators for microelectrode positioning. Two important features characterize the MP-300 -- submicron resolution over a large range and inherently stable, locking piezoelectric stage movement. These features, combined with user-programmable attributes, make the MP-300 ideal for a broad range of micromanipulator requirements.

The MP-300's 1/2 inch of axis travel (in all three directions) allows users to easily maneuver at high speed into the desired microscopic field using the very same remote control used to delicately approach targets with ultra-small steps. Drift-free operation is assured by the solid-state piezo-driven actuators which automatically clamp the axis drive blade in the absence of a driving signal. Submicron step resolution is available over the entire 1/2 inch excursion for all three axes. The remote control input is user-programmable allowing a wide range of configurations for axis movement and controller response. Furthermore, remote control can be easily disabled at any to time to prevent accidental movement.

The MP-300 is endowed with ultimate versatility. Functions programmable at the front panel include step size and frequency in the Continuous Mode, Step size in the single-step pulse mode, axes direction assignments, and remote control sensitivity. The

MP-300 comes equipped with a joystick for remote control. One button on the joystick is programmed to switch the assignment of two axes for one direction of joystick movement.

Another is programmed to activate either turbo mode for rapid movements or single-step mode which can be used for precise, fine movement or large jumps for impalement with microelectrodes. Force-Sensitive Resistor remote control (FSR pad) will be available soon as an option.

The vertical and bottom stages (nominally the Z and X axes) are counterbalanced by adjustable spring loads to accommodate various headstage weights and angles of attack. Additionally, the upper stage (nominally the Z axis) may be rotated 180 degrees for right-handed or left-handed operation.

The MP-300 comes complete with three orthogonal stages, controller unit, joystick remote control, cables and manual. Each Controller unit can control two MP-300 micromanipulators.

Programmable features:
Axes and direction assignment to X and Y joystick movements. Turbo mode speed "Swap Button" for assignment of third axis to either X or Y. Continuous mode step size and frequency. Joystick movement sensitivity (Central "dead zone" width) .Single-step mode step size.

Axis Driver Specifications
Maximum Excursion: 0.5 inch (12.5 mm)
Step Resolution: 2 microinch (0.4 um)
Slew Rate: 1 inch/s (25 mm/s)
Holding Force: approx. 14 oz. (0.4 kg)
Stall Force: approx. 8 oz. (0.2 kg)

Dimensions
With stages at maximum limits: 2 3/8 W, 3 3/8 L, 2 3/4 H inches.

Price $5950.00 Available now

SUTTER INSTRUMENT COMPANY 40 LEVERONI COURT NOVATO CALIFORNIA 94949 415/883-0128 FAX 415/883-0572

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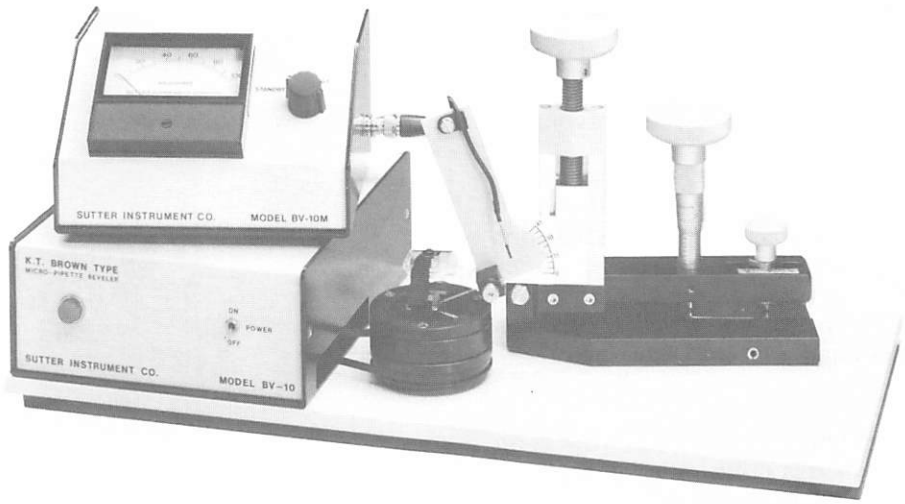
MODEL BV-10 — K.T. BROWN TYPE MICROPIPETTE BEVELER



The Model BV-10, K.T. Brown Type Micropipette Beveler will bevel microelectrodes and pipettes between 0.1 and 50.0 microns tip diameter. Beveling can be accomplished very rapidly to produce consistent tip diameters using the techniques described by Brown and Flaming, Science, August 1974, Volume 185.

Beveling electrodes not only reduces the tip diameter but also produces extremely sharp pointed electrodes while at the same time lowering the electrical resistance at the tip. This greatly facilitates penetrating and holding very small or difficult cells.

Microinjection needles also benefit from beveling by promoting entry into cells with minimal damage to the cell and at the same time enhancing flow of material through the needle.*

*Beveling of tips greater than 1 micron, does not require the meter. Contact Sutter Instrument Co. for details on large tip beveling.

Description

The model BV-10 consists of a grinding pedestal with an optically flat surface mounted on a heavy base plate. This serves as a bearing for an abrasive coated flat optical glass grinding plate.

The optically flat abrasive plate is coupled to a low vibration slow speed motor by means of magnetic fields to provide a vibration-free flat grinding surface.

A two stage micromanipulator holds the electrode to be beveled and permits the electrode to be advanced onto the abrasive surface for beveling. The bevel angle and speed of advancement are adjustable.

An integrated circuit electronic resistance meter completes the system. For microelectrode beveling, the meter is used to monitor tip resistance during the beveling operation.

Specification and Ordering Information

Beveling
Range: 0.1 through 50
micron finished electrodes.

Grinding Surface Variation: Less than 1 micron.

Grinding
Speed: 60 revolutions per minute

Beveling Angle Range: 5 degrees through 90 degrees, adjustable.

Micromanipulator: Coarse drive 0.075" per dial revolution. Fine drive 0.0004" per dial revolution adjustable through 0.002".

Abrasive Plates: Two abrasive plates are supplied with the instrument, 0.05u and 0.3u grit. Other grit sizes are available, and may be substituted depending on application. Standard abrasive plates use alumina particles. Plates using diamond dust are available on request.

Electrode Impedance Meter: The BV-10M is an analog design, which is preferred over digital monitoring systems when following a trend in changing resistance during the beveling operation. The BV-10M is a three-range (0-10, 0-100, 0-500 megohm) meter. Measurements are made at 12 Hz to minimize capacitive contributions to the impedence measured, thus providing a near true DC resistance value. A very rapid roll off is used to reduce 50/60 Hz interference. This allows for operation in a laboratory environment without screening.

Power Requirements: 117 volts 50/60 Hz AC, 12 watts. For operation at other voltages, please specify voltage and frequency required.

The Model BV-10: Supplied with base unit and motor, micromanipulator, a BV-10M impedance meter, two interchangeable abrasive plates and all other accessories required for beveling electrodes.

Warranty: Three year limited warranty, parts and labor. Repairs or modifications without factory authorization, misuse or abuse will void warranty. Abrasive plates, drive belts, and other consumables are excluded.

Weight: Approx. 45 lbs.

Shipping: F.O.B. Novato, CA

Terms: Net 30

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NA-1 SYRINGE DRIVER

The NA1 Syringe Driver, manufactured by Sutter Instrument Company, provides means for precisely advancing the plunger of small volume syringes. The unit is designed for microinjection studies and any experimental procedure requiring the delivery of precise fluid volumes. The instrument consists of two units: 1) a mechanical syringe drive unit, and 2) a versatile microprocessor based control unit. A foot switch is included for activating the drive unit and the control unit contains an audible signal that indicates duration of injection. A TTL level connector allows for computer controlled activation of injection.

The control unit can accommodate a total of ten programs, each program consisting of values for amount and rate of injection, background rate of injection (to prevent clogging of pipette tips), and rates for fast filling and dumping of solutions.

Each instance of pressing the 'Inject' key or depressing the foot switch will cause the unit to deliver a selected quantity in 0.5nl steps when using a 50 microliter syringe, (the programmable range being 1-225 steps.) The rate at which the steps are being taken is also selectable. At the highest rate, 255 steps would be taken in less than 0.2 seconds. At the lowest rate, the INTERVAL between each step would be about 1 second; 225 seconds to complete 255 steps. The unit can be easily programmed to retract the syringe plunger in response to the inject command. The volume and rate values available are the same in either direction.

Enabling the Background mode allows for continuous advance or retraction of the syringe plunger in steps equivalent to .04nl (again using a 50 microliter syringe.) Selection of the slowest background rate would cause these steps to occur at about 3.5 second intervals, resulting in emptying of the syringe in a little over 40 days! The highest Background rate causes steps to occur at 0.7ms intervals, thereby emptying the syringe in about 11 minutes. Background delivery can be disabled by entering a rate of zero.

Two modes of rapid plunger movement have been provided to speed setup and maintenance. The basic fast mode allows the plunger to be moved from one end of its travel to the other in just over thirty seconds. The 'fill/dump' mode allows the user to select the rate of fast movement ranging from 1 to 5000 steps per second, each step being the equivalent of 0.165nl. Both rapid modes are bi-directional.

The NA-1 is offered with a 50 microliter syringe, a three-way valve and a pipette holder for 1mm OD pipetes. These items are industry standards and are interchangeable with other sizes; different volume syringes may be substituted to obtain varying delivery volumes per step.

PRICE: $2950.00
(Includes: drive unit, microprocessor control unit, interface cable, foot switch, 50ul syringe, 3-way valve, pipette holder, interface cable, manual and power cord.)

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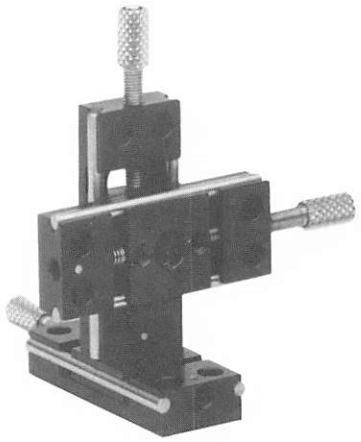
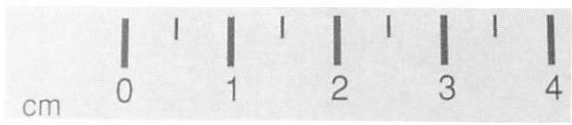
INTRODUCING THE MICRO MINI STAGE MODEL MM-1 & MM-3

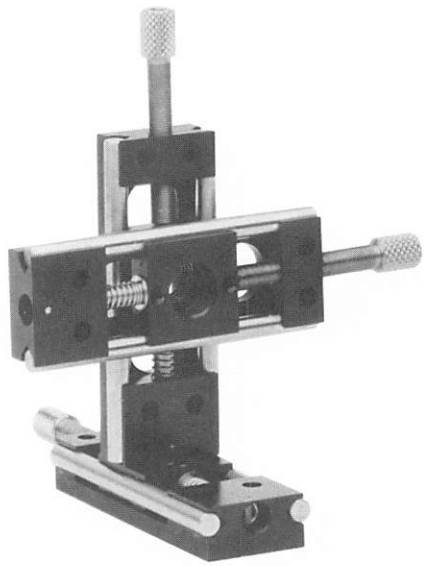
These unique micropositioners are a dimensional breakthrough. They are precision instruments designed to eliminate many research and design problems, especially in the case of space limitation.

Features:

- Black anodized aluminum body with stainless steel tracks.
- Precise: Straightness within 1 micron or better on the MM-1 and 2 micron or better on the MM-3.
- Smooth motion: Less than 1 micron maximum wobble on the MM-1 and less than 2 micron maximum wobble for the MM-3.
- See-thru .155" tapped hole for transmission and/or adaptors for the MM-1 and 5/16" tapped hole for transmission and/or adaptors for the MM-3.
- Little Backlash, positive spring loaded carriage.
- 1/8 inch travel for the MM-1 and 1/2 inch travel for the MM-3.
- Fine 64 TPI screw adjustment with allen socket end for the MM-1 and Fine 40 TPI for the MM-3.
- Thermal Stability: 40°F to 250°F for the MM-1 and 50°F to 200°F for the MM-3.
- Sturdy one piece base, three piece construction.
- Size: Single stage is only .20" x .44" x 1.03" long for the MM-1 and .28" x .66" x 1.75" long for the MM-3.
- Constructable into XY and XYZ configurations without special adapters and without dismantling the basic unit.
- Price: Justifiable for even minor applications.







PRICE LIST

MM-1 X, single stage	$ 70.00	ea	3.6 gms
MM-1 XY, double stage	135.00	ea	7.4 g
MM-1 XYZ, triple stage	195.00	ea	11.2 g
MM-3 X, single stage	90.00	ea	14.3 g
MM-3 XY, double stage	175.00	ea	28.8 g
MM-3 XYZ, triple stage	240.00	ea	44.6 gms

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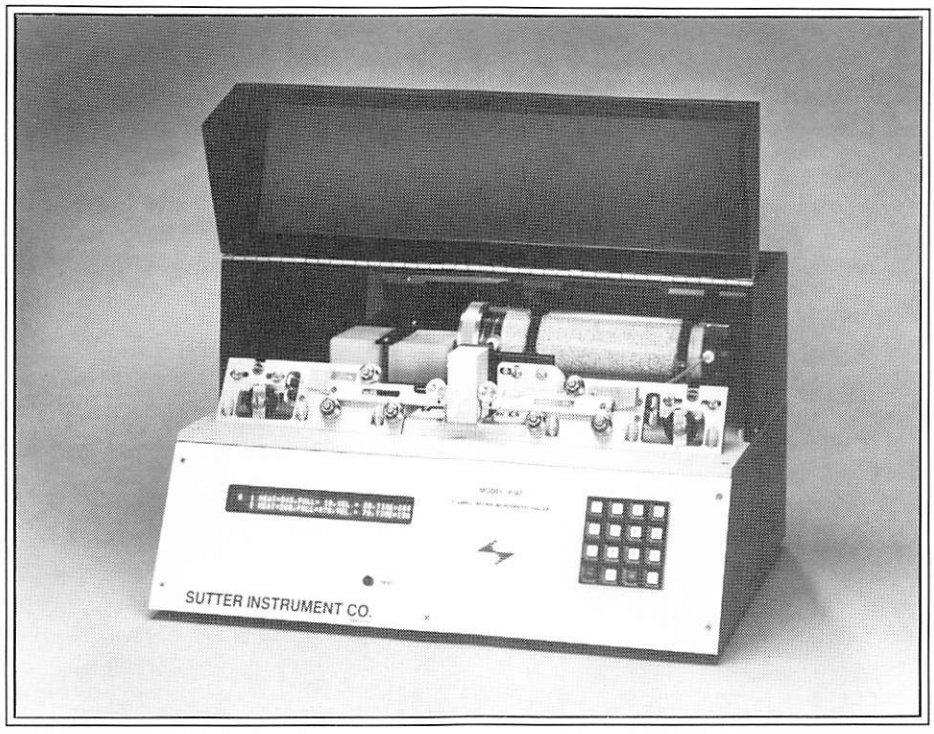
MODEL P-97
FLAMING/BROWN TYPE MICROPIPETTE/PATCH PIPETTE PULLER



The model P-97 micropipette puller is the latest generation of the Brown/Flaming type puller design, suitable for fabrication of micropipettes, patch pipettes and microinjection needles. While still retaining many of the features found on the Model P-87, the P-97 offers added versatility, improved electronics, and a higher degree of reproducibility.

The P-97 combines a proven mechanical system with a sophisticated, programmable microprocessor controller. Programmable control of the pulling parameters allows investigators to design application-specific pipettes from a multitude of glass compositions and sizes.

The changes incorporated in the P-97 allow for tighter control of the pulling process with a higher degree of reproducibility.

Mechanical Improvements

A humidity controlled chamber enclosing the heating element to minimize the effects of ambient humidity on the pulling process.*

New smaller filament clamping jaws to minimize heat retention.

*Patent Pending

Electronic Improvements

Higher power—a 25% increase in power allowing for the use of larger heating filaments, larger diameter glass and multibarreled glass.

A new vacuum fluorescent display allowing easy viewing from any direction.

New electronic components for improved noise rejection and higher accuracy.

Software Improvements

Gas delivery mode switch allows extended cooling for large diameter, multibarrel glass; useful for needle fabrication.

The total time the heat is on in a program is displayed for improved program development and troubleshooting.

Programmable air pressure.

Extended program capacity from 10 to 100 programs.

Adjustable gas cooling of filament to minimize filament clamp heat retention.

Write protection lock to protect programs from being cleared.

Standard Features

Pulls electrodes consistently and reliably, with tip diameters ranging from greater than 1 um to less than 0.1 um.

Pulls electrodes with tapers ranging from 6 mm to 24 mm with little or no change in tip diameter.

Pulls two symmetrical electrodes with each pull.

Preprogrammed with sample programs for intracellular, patch and microinjection pipettes.

Measures velocity of the system as the glass softens and begins to pull apart. Velocity allows for selection of a precise glass temperature as the tip point for the hard pull.**

Ramp Test, self test for establishing program heat.

Constant current power supplies for filament, and pull solenoid.

Looping pull cycle for fabrication of patch clamp pipettes.

Operates on the principle of rapid cooling of the electrode heater to give fine tipped pipettes with extremely short tapers.

Pulls pipettes with gradual taper at tip to facilitate holding cells.

**Patent #4,600,424

Technical Support

As with any of our instrumentation, your purchase of a P-97 assures you comprehensive technical support at no cost, from the world leader in micropipette technology.

Specifications and Ordering Information

Size: 21" x 24" x 12"

Weight: Approx. 55 lbs.

Electrical: Operates on 115/230 Volts, 50/60 Hertz power line.
Please specify when ordering.

Warranty: One year limited warranty, parts and labor. Repairs or modifications without factory authorization, misuse or abuse will void warranty. Filaments are excluded.

Shipping: F.O.B Novato, CA.

Terms: Net 30 Days.

Quality Control

Sutter Instrument Company, as a leader in the production of high quality micropipette pullers, takes great pride in the quality of its products. We maintain a complete scanning EM facility in-house to check the performance of each micropipette puller before it is shipped.

In the case of the P-97, each puller is tested by pulling a group of pipettes which are then examined with the SEM. All the pipette tips must measure less than 0.1u (typical result–0.06u) before the puller is approved for shipment. Included with each P-97 is a photograph of one of the electrodes pulled on that puller. This level of quality control is offered by no other manufacturer of micropipette pullers.

References

(These references describe the Brown/Flaming series pullers and contain valuable information applicable to the P-97).

Brown, K.T., and Flaming D.G., Neurosciences Journal, 1977, Vol. 2, pp. 813-827.

Flaming, D.G., and Brown, K.T., Journal of Neuroscience Methods, 1982, Vol. 6, pp. 91-102.

Brown, K.T., and Flaming, D.G., Advanced Micropipette Techniques for Cell Physiology, John Wiley and Sons. Great Britain, 1986.

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MODEL P-87

FLAMING/BROWN TYPE PATCH PIPETTE MICROPIPETTE PULLER

Sutter Instrument Company Model P-87 retains many of the advanced features of our previous models while providing increased convenience for the user. The P-87 utilizes constant current power supplies for both the filament and pull solenoid, velocity sensing for determining the trip point, and active/passive cooling. The P-87 combines a proven mechanical system with a sophisticated, programmable microprocessor controller to produce a puller with extraordinary capabilities.

The P-87 features a sophisticated low pressure gas delivery system which eliminates the need for gas cylinders.

Front panel controls allow for the setting of gas delivery pressure. Filters in the system dry the delivered gas, thus mitigating the effects of humidity on electrode shape and tip size.

The programming system allows for a total of ten programs, each program consisting of a maximum of 16 cycles. Each cycle contains a value for pull strength, heat, velocity and timing of gas flow. In addition, the puller is capable of 'looping' continuously through a short program until pipette formation has occurred.

The P-87 contains a 'ramp test' to overcome the difficulties of program adjustment when a new filament is installed or to help characterize a new glass/filament combination. This test allows for the rapid adjustment of heat values in established programs, and provides estimates for establishing heat settings when using new sizes or compositions of glass capillaries.

Features

A completely self-contained air supply with humidity control and built in filtration system eliminates the need to refill a nitrogen tank.

The investigator has control over the air 'flow time' and the pressure at which the air is delivered.

A complete 'brown-out' sensing circuit is incorporated into the instrument; an automatic shut down occurs when the line voltage drops below a critical level. Conversely, when the line voltage has returned to acceptable levels, the instrument automatically powers up and restores itself without the loss of program values.

A memory test is incorporated for testing the integrity of the programmable memory.

The velocity sensing circuit has been optimized for maximum sensitivity and reproducibility.

A back-lit, super twist LCD display provides better clarity.

Standard Features

Pulls electrodes with tip diameters less than 0.1u consistently and reliably.

Pulls electrodes with tapers ranging from 6mm to 24mm with little or no change in tip diameter.

Pulls two symmetrical electrodes with each pull.

Measures velocity of the system as the glass softens and begins to pull apart under a constant load. The increasing velocity of the initial pull is determined by the viscosity of the glass, which in turn is a function of the glass temperature. The adjustable velocity allows for selection of a precise glass temperature as the trip point for the hard pull.**

Capable of storing 10 different programs to facilitate usage by more than one investigator.

'Ramp test' allows for rapid adjustment of program parameters when a new filament or glass is introduced.

Constant current power supplies for filament and pull solenoid.

Looping pull cycle for fabrication of patch-clamp pipettes.

Operates on the principle of rapid cooling of the electrode heater to give fine tipped pipettes with extremely short tapers, thereby producing stiff pipettes suitable for beveling.

Pulls pipettes with gradual taper at tip to facilitate holding cells after penetration.

Other benefits of the short taper are reduced tip resistance and decreased capacitative coupling in two barrelled microelectrodes.

Options

A high power option is available for the P-87. This option is recommended for investigators using large diameter glass (> 2mm O.D.), multibarrel glass, and/or long tapers requiring filaments wider than the 4.5mm trough or 3mm box. Please specify when ordering.

**Patent No.4,600,424

Specifications and Ordering Information

Size:	21" x 14" x 12"
Weight:	Approx. 55 lbs.
Electrical:	Operates on 115/230 Volts, 50/60 Hertz power line.
Warranty:	One year limited warranty, parts and labor. Repairs or modifications without factory authorization, misuse or abuse will void warranty. Filaments are excluded.
Shipping:	F.O.B. Novato, CA
Terms:	Net 30

Quality Control

Sutter Instrument Co., as a leader in the production of high quality micropipette pullers, takes great pride in the quality of its products. We maintain a complete scanning EM facility in house to check the performance of each micropipette puller before it is shipped. In the case of the Model P-87 each puller is tested by pulling a group of pipettes which are then examined with the SEM. All the pipette tips must measure less than 0.1u (typical result - 0.06u) before the puller is approved for shipment. Included with each P-87 is a photograph of one of the electrodes pulled on that puller. This level of quality control is offered by no other manufacturer of micropipette pullers.

References

(These references describe the original P-77 series pullers, but contain valuable information applicable to the P-87.)

Brown, K.T. and Flaming, D.G., Neuroscience Journal, 1977, Vol 2, pp.813-827.

Flaming, D.G. and Brown, D.T., Journal of Neuroscience Methods, 1982, Vol 6, pp.91-102.

SUTTER INSTRUMENT COMPANY

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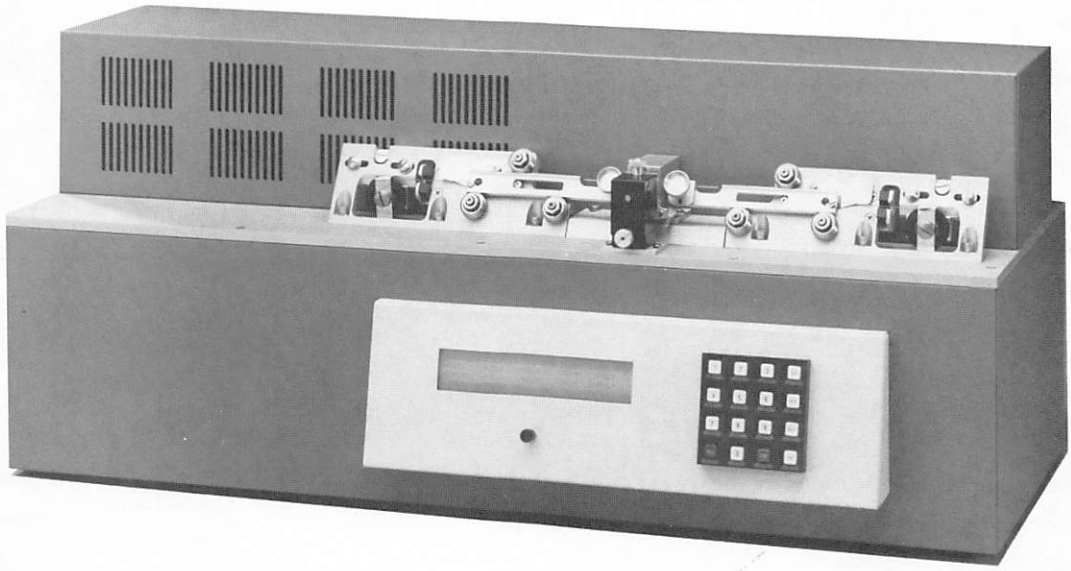
MODEL P-2000 QUARTZ MICROPIPETTE PULLER



The laser based, quartz micropipette puller Model P-2000* is the result of an extensive Research & Development effort by Sutter Instrument Company. Utilizing the proven mechanical system of the Flaming/Brown Type Puller Model P-87 in combination with a powerful CO_2 laser and a sophisticated, programmable microprocessor controller, the P-2000 represents a significant advance in the technology of micropipette fabrication.

Quartz and synthetically produced fused silica are exceptionally pure silicon dioxide materials possessing superior qualities for electrophysiological research. (For purposes of this discussion, the terms quartz and fused silica will be used interchangeably.) Prior use of quartz has been limited because its melting point exceeds that of conventional metal filaments. With the advent of the P-2000, investigators may now take advantage of the superior mechanical strength and ultra-fine tip formation capabilities of quartz not achievable with other glass formulations. Using quartz, Sutter Instrument Company has pulled electrodes with tip diameters less than 0.01 microns.

Preliminary reports indicate that quartz pipettes can penetrate tough tissues that would normally break conventional pipettes and that quartz pipettes are reusable.[1] Thin-wall quartz can form tips that can penetrate cells as well as thick-wall borosilicate yet the thin-wall quartz will have a larger pore size and therefore lower resistance.

Quartz exhibits superior electrical characteristics demonstrated by a low dielectric constant, a low loss factor and a volume resistivity that is orders of magnitude greater than borosilicate. Based on the above properties, quartz should have superior noise performance when compared to pipettes made from any other glass. With the exception of quartz, all common glasses incorporate metal ions to decrease their melting point. By eliminating these metal ions recording artifacts and alteration of channel kinetics may be minimized.[2]

Optically, quartz is virtually free from fluorescence when illuminated.

Several factors led to the selection of a laser as the heat source for quartz pipette fabrication. Laser heat is clean; it does not leave an evaporative metal residue on the pipette as do conventional filaments. The end user can program the amount of heat (power) to be supplied to the glass, and define the pattern of heat distribution along the glass. The laser leaves no residual filament heat; when the laser is turned off heat delivery to the glass stops instantly eliminating the need for an air jet cooling system.

*U.S. Patent #'s: 4,921,522; 4,913,719; 4,869,745. International patents pending.

The P-2000 can store up to 64 separate programs, with each program consisting of up to 16 command lines. Programmable parameters include Heat, Pull Strength, Velocity (criteria for trip point), Filament type, and Delay time between the trip point and the hard pull.

The P-2000 contains a 'ramp test' which initiates a 'self-test' to insure proper function and facilitates filament adjustment by reporting recommended Heat value for the glass/filament combination.

The P-2000 has been developed for use with 1.0mm O.D. tubing and at this time no other O.D. size is recommended.

Features

Ease of programmability combined with the freedom of programmable filaments allows one instrument to be used for many different research projects.

The laser is not self limited due to a melting point as with conventional metal filaments, and therefore cannot be 'burnt out.'

Pulls electrodes with tip diameters less than 0.03 microns.

Measures velocity of the system as the glass softens and begins to pull apart under a constant load. The increasing velocity of the initial pull is determined by the viscosity of the glass, which in turn is a function of the glass temperature. The adjustable velocity allows for selection of a precise glass temperature as the trip point for the hard pull. (Patent No. 4,600,424)

The laser is completely contained ensuring operator safety.

Operating life of the CO_2 laser is expected to be in excess of 5 years with normal use, after which the laser can be refurbished by the Sutter Instrument Company for a nominal charge.

Though the P-2000 was designed specifically for quartz tubing it can easily handle both borosilicate and aluminosilicate glasses.

References

1. Munoz, J.L. and J. Coles. Quartz micropipettes for intracellular voltage microelectrodes and ion selective microelectrodes. J. of Neuroscience Methods. 22:57-64, 1987

2. Zuazaga, C., and A. Steinacker. Patch-clamp recording of ion channels: Interfering effects of patch pipette glass. News in Physiological Science. 5:155-159, 1990

Specifications and Ordering Information

Quartz tubing is available through Sutter Instrument Company.

Size & Weight: 37" x 19" x 19"

Electrical:	Operates on 115/230 Volts, 50/60 Hertz power line.
Warranty:	One year limited warranty, parts and labor. Repairs or modifications without factory authorization, misuse or abuse will void warranty.
F.O.B.	Novato, CA
Terms:	Net 30

Quality Control

Sutter Instrument Company, as a leader in the production of high quality micropipette pullers, takes great pride in the quality of its products. We maintain a complete SEM facility in house to check the performance of each micropipette puller before it is shipped. In the case of the Model P-2000, each puller is tested by pulling a group of pipettes which are then examined with the SEM. All the pipette tips must measure less than 0.05u (typical result—0.03u) before the puller is approved for shipment. Included with each P-2000 is a photograph of one of the electrodes pulled on that puller. This level of quality control is offered by no other manufacturer of micropipette pullers.

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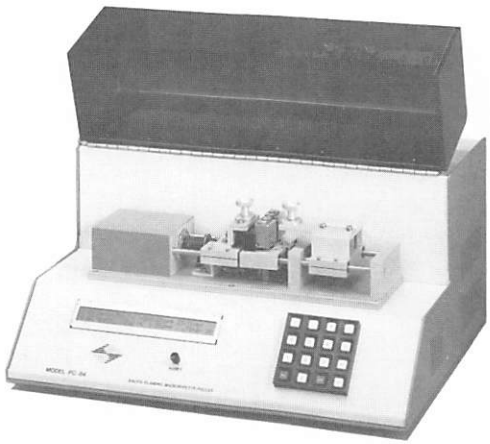
MODEL PC-84 — SACHS-FLAMING TYPE PATCH PIPETTE/MICROPIPETTE PULLER



The Sutter Instrument Model PC-84 Puller is a programmable puller capable of fabricating micropipettes for patch-clamp recording, micro-injection, and other researches not requiring ultra fine tip pipettes. Utilizing a moving filament design, it pulls two essentially identical pipettes, and does not require a repositioning of the glass or filament when executing a multi-cycle pull. The non-volatile memory can store a maximum of ten programs, each program encompassing 16 pull cycles. Each pull cycle consists of a pull strength value, a filament temperature value and a position or time value. Thus, the glass can be worked sequentially at differing pull strengths and temperatures over varying distance or time intervals. This mode of operation allows the PC-84 to produce a myriad assortment of pipette profiles in both 'soft' and 'hard' glasses. Reproducibility is maximized by use of constant-current power supplies for controlling pull strength and filament temperature.

The PC-84 is designed for convenient operation. On applying power, the instrument inquires as to the 'pulling program' in a menu driven fashion. During normal operation, glass loading and pipette removal are all that is required mechanically.

To facilitate program adjustment when a new filament is installed or to help characterize a new glass/filament combination, this instrument contains a 'ramp test.' This allows for the rapid adjustment of heat values in established programs, while providing estimates for establishing heat settings when new sizes or compositions of glass are introduced.

Features

Pulls electrodes with tip diameters less than 0.2u consistently and reliably.

Pulls electrodes with taper lengths ranging from 8mm to 15mm with little or no change in tip diameter.

At 0.2u, tip diameters tend to be steeply tapered. This produces a lower resistance at the tip than is to be found in other pullers that do not utilize a gas jet cooling system.*

Pulls two symmetrical electrodes with each pull.

Capable of storing 10 different programs to facilitate usage by more than one investigator.

'Ramp test' allows for rapid adjustment of program parameters when a new filament or glass is introduced.

Constant current power supplies for filament and pull solenoid.

Looping cycle for fabrication of patch-clamp pipettes.

*Steep tapers may be incompatible with penetration of cells deep in tissues.

Specifications and Ordering Information

Size:	16" x 14" x 8"
Weight:	Approx. 40 lbs.
Electrical:	Operates on 115/230 volts, 50/60 Hertz power line. Externally switchable.
Warranty:	One year limited warranty, parts and labor. Repairs or modifications without factory authorization, misuse or abuse will void warranty. Filaments excluded.
Shipping:	F.O.B. Novato, CA
Terms:	Net 30

Quality Control

Sutter Instrument Co., as a leader in the production of micropipette pullers, takes great pride in the quality of its products. We maintain a complete scanning EM facility in house to check the performance of each micropipette puller prior to shipment. In the case of the Model PC-84, each puller is tested by pulling a group of pipettes which are then examined with the SEM. All pipette tips must measure less than 0.2u (the actual average tip being 0.12-0.15u) before the puller is approved for shipping. This level of quality control is offered by no other manufacturer of micropipette pullers.

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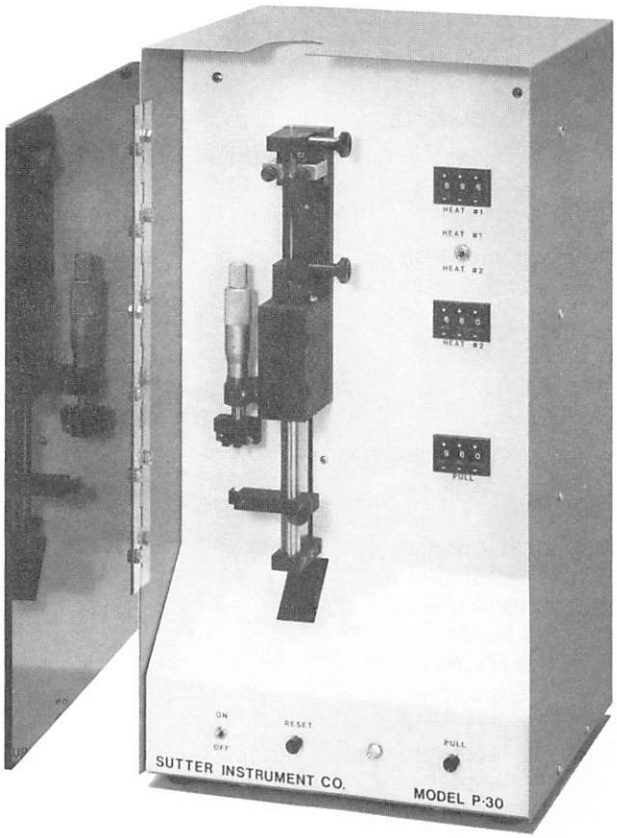
MODEL P-30 — VERTICAL PIPETTE PULLER



The Model P-30 pipette puller is designed for the fabrication of 'basic' micropipettes and patch type pipettes. It will pull micropipettes with tip diameters as small as 0.3 micron and moderate taper lengths (10 to 15 millimeters). Using an included patching attachment, the P-30 will pull the standard double-pull patch type pipette. Used with thin-wall glass capillaries, it will generate pipettes or needles suitable for microinjection studies. The P-30 is ideal for student laboratories and other situations which call for an economical, reliable pipette pulling device.

Features

Pulls electrodes with tip diameters down to 0.3u consistently and reliably.

A micrometer allows precision reproducibility of trip point settings in producing fine tipped microelectrodes.

Full 3-digit digital controls for accurate setting of heat and pull valves.

Constant current power supplies for filament and pull solenoid.

Dual (manually) switched heat settings for patch pulling or two different types of micropipettes.

Enclosed front to reduce variability caused by drafts.

All working parts are made from corrosion resistant material.

Two heating assemblies available: platinum/iridium (recommended) or nichrome coil. Please specify when ordering.

Platinum filaments are more efficient at heating and cooling than nichrome filaments, but are also prone to damage. While nichrome is suitable for many applications, platinum is recommended for large diameter, thick wall and aluminosilicate glass and applications requiring shorter taper lengths.

Built in RFI filter and dual voltage/dual frequency operation.

Rubber padded jaws to minimize breakage of capillary tubing.

Designed to take up a minimum of bench space.

Slope of the front panel aids in preventing broken glass from entering the cabinet/solenoid mechanism.

Specifications and Ordering Information

When ordering please specify nichrome or platinum filament holder.

Size:	18" x 10" x 9"
Weight:	Approx. 35 lbs.
Electrical:	Operates 115/230 volts, 50/60 Hertz power line.
Warranty:	One year limited warranty, parts and labor. Repairs or modifications without factory consent, misuse or abuse will void warranty. Filaments excluded.
Shipping:	F.O.B. Novato, CA
Terms:	Net 30

Quality Control

Sutter Instrument Co., as a leader in the production of micropipette pullers, takes great pride in the quality of its products. We maintain a complete scanning EM facility in house to check the performance of each micropipette puller before it is shipped. In the case of the Model P-30, each puller is tested by pulling a group of pipettes which are then examined with the SEM. All pipette tips must measure equal or less than 0.3u before the puller is approved for shipping. This level of quality control is offered by no other manufacturer of micropipette pullers.